RX J0719.2+6557: A New Eclipsing Polar

G. Tovmassian (UNAM, Mexico), J. Greiner, F.-J. Zickgraf (Garching, Germany), P. Kroll (Sonneberg, Germany), J. Krautter, I. Thiering (Heidelberg, Germany) and A. Serrano (INAOE, Mexico)

Abstract. A new magnetic, eclipsing cataclysmic variable is identified as the counterpart of the X-ray source RX J0719.2+6557 detected during the ROSAT all-sky survey. The relative phasing of photometric and spectroscopic periods indicates a self-eclipsing system. Doppler tomography points to the heated surface of the secondary as a strong source of emission and of diskless accretion. Near-infrared spectroscopy revealed two unusual strong emission features originating on the heated side of the secondary.

Within a program for optical identification of a complete sample of northern ROSAT All-Sky Survey sources we identified a new cataclysmic variable. The X-ray source RX J0719.2+6557 (= 1RXS J071913.4+655734) is detected with a total of 66 photons, which corresponds to a vignetting corrected countrate of 0.16 cts/s. No strong variability in the X-ray intensity is seen at this level.

Optical CCD photometry (Johnson B filter) was performed on 15, 16 and 17 of April 96 at Sonneberg Observatory and clearly reveals an eclipsing lightcurve with the following orbital elements: Min. = HJD $2450189.46326 + 0\overset{\mathrm{d}}{.}0682297 \times \mathrm{E}$. The eclipse FWHM is about 6 min. The light curve of the system in between eclipses is rather flat in comparison to other self-eclipsing polars (Stockman 1995, Schwope et al. 1995).

Optical spectroscopy was performed at the 2.1 m telescope of the OAN SPM in April 1996 in two wavelength ranges: $\lambda\lambda 3600 - 5400 \mathring{A}$ with $4 \mathring{A}$ FWHM resolution and $\lambda\lambda 6000 - 9000 \mathring{A}$ with $6 \mathring{A}$ resolution. The typical Balmer lines accompanied with strong He I and He II lines in emission strongly suggests a magnetic nature of this CV. The 98.2 min. period derived from the moments of eclipses coincides with the spectroscopic period within error limits. Based on the large semi-amplitude of the RV curves and their relative narrowness for an eclipsing system, we conclude that the emission lines come mostly from the XUV illuminated hemisphere of the secondary star. Thus, phase 0 (–/+ crossing of RV curve) corresponds to the inferior conjunction of the secondary. The eclipse occurs at phase 0.4 and is seen also in the continuum when the accretion shock disappears partially or entirely behind the WD. The nature of the X-ray spectrum, the synchronized WD spin and orbital period, define RX J0719.2+6557 as a self-eclipsing polar.

The near-infrared spectra (Figure 1) reveal two strong features at $\lambda 8200 \mathring{A}$ and $\lambda 8660 \mathring{A}$. These coincide with the location of the Na I doublet and the component of the Ca II triplet. These lines are seen as absorption features seated on tremendous broad emission. Friend et al. (1988) did not find any such emission in a large sample of CVs, although similar but much fainter features

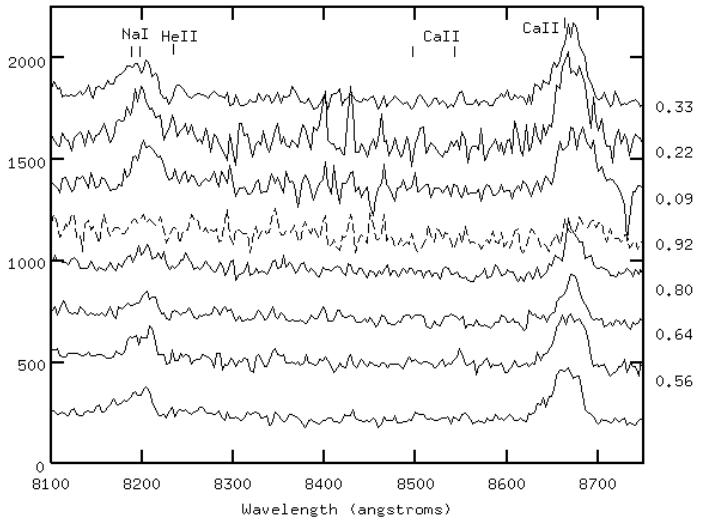

Figure 1. Spectra of RX J0719.2+6557 in the red region. The orbital phases are marked on the right side.

showed up in some accretion disc systems after subtraction of the secondary's spectra. These were referred to as "disc component" by Friend et al. (1990). In our case these lines originate on the leading side of the secondary or on the line of sight between the two components, because they both significantly decrease during the inferior conjunction of the secondary (phase 0.0).

The backprojection method (Horne 1991) was applied on the lines of He II and H_β with the phase registration adopted above. It is evident that the He II emission region is compact and concentrated at the expected location of the secondary, with a possible motion along an horizontal stream. Unlike He II, H_β shows more diffuse distribution around secondary and the inner L_1 point. There is also some evidence of a vertical stream in the light of H_β. Such feature was observed in a similar system (Schwope et al. 1995), but its nature is not clear. Although we have fewer spectra in the red, it is obvious that the emission features in this region are strongly concentrated on the leading side of the secondary or along the vertical stream observed in H_β.

References

Friend M.T., Martin J.S., Smith R.C., Jones D.H.P., 1988, MNRAS, 233, 451.

Friend M.T., Martin J.S., Smith R.C., Jones D.H.P., 1990, MNRAS, 246, 637.

Horne K., 1991, in Fundamental Properties of CV Stars, ed. A.W. Shafter, SDSU, 23

Schwope A.D., Schwarz R., 1995, in Cape Workshop on MCVs, A.S.P. Conf. Ser. 85, 166

Stockman H.S., 1995, in Cape Workshop on MCVs, A.S.P. Conf. Ser. 85, 153